

## OBSERVATIONS ON NĂVODARI FLOOD PRODUCED IN THE CITY AND TOWNS NEARBY IN THE PERIOD 1994 – 2004

**Daniela – Mirela Pleșoianu, Marius Lungu<sup>1</sup>**

**Abstract.** Due to their high intensity, torrential rains exerts a powerful mechanical action on vegetable carpet, as on the ground, causing the phenomena of erosion surface and in depth (streaming, wheel track cutting, ravines). They also determined a series of hydrological phenomenon on rivers (increase in the level, flow rates, increase the amount of sediment, flood, caving in of the banks, breaking the jetties). The amount of downed water during these heavy rain, by the force or fare quote with which runs out on slopes, result in the degradation of land, especially of those which are on the slope. Therefore, the study of these rains is of great importance to many fields such as: design and planning of hydraulic structures, drainage works and systematic urban and rural work, hydro-improvement work for the agricultural land, river transport.

*Keywords: intensity, flood, flow rates, frequency*

### **1. Introduction**

The climate of Năvodari city falls on the background of continental temperate climates, giving certain characteristic feature related to geographical position and the physico-geographical territory. The existence of a permanent Black Sea water evaporation, humidity and also provides heating causes its regulation (Pleșoianu, Daniela, 2011). Circulation of air masses is influenced by the Siberian winter anticyclone which reduces rainfall and causes Azores anticyclone summer temperatures and drought. Sea influences are felt by long, warm autumns, and by late and cool spring. The prevailing wind is blowing in the N-NE, characterized by low humidity in summer, while winter brings blizzards and frost. Characteristic to the area are the day and night breezes. These vents provide strong local winds.

### **2. Rainfall in the city Năvodari recorded during 1994 – 2004**

Floods during 1994-2004 is grafted amid amounts of rainfall recorded. To support this statement we describe, briefly, precipitation in the period 1994-2004, working with Weather Station Constanta, which is located near the village Năvodari. The processed data source is the Romanian Statistical Yearbook. To illustrate the average quantities of precipitation we use available data from 1994 - 2004 shown in table 1.

---

<sup>1</sup> Ovidius University of Constanța, Faculty of Nature Science and Agriculture Science, Constanța, Romania, *plesoianu\_daniela@hotmail.com*

Table no. 1 Monthly and annual average rainfall in Constanta from 1994 to 2004

Months Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Amount Year
1994	17,2	2	20,8	18,6	15,2	34,5	53,8	31	3,5	62	7,9	57,6	324,1
1995	85,9	6,3	95,7	28,7	23,8	55,1	2,3	14,5	99,8	31,1	110,6	50,5	604,3
1996	23	47,5	29,9	35,1	45,7	6,3	27,8	10,3	97,5	20,7	30,8	68,8	443,4
1997	9,4	15	31,5	89	108	47,2	124,5	79,2	2,9	42,8	53,7	37,2	650,1
1998	26,9	22,3	32,5	6,4	33,1	39,8	36,9	18,5	92,7	46	107,7	25,9	498,5
1999	13,7	20,4	36,5	51,1	31,3	62,1	9,7	100,4	71,6	59,1	19,7	55,5	531,1
2000	44,4	16,4	26,9	18,1	15,1	71,4	10,2	1,2	25,7	8,4	28,7	11,3	277,8
2001	5,5	58,5	53,1	48,6	30,1	30,9	2,7	29,6	71,4	2,8	47,3	19,9	400,4
2002	15,1	4,7	82,1	16,6	19,3	21,2	20,4	50,6	57,1	61,3	34	45,2	431,6
2003	53	14,9	16,9	25,4	5,2	9,1	32,9	0,2	80,1	63,7	25,5	23,3	350,2
2004	51,3	20,2	25,9	2,3	100,2	59	38,3	259,2	27,4	13,5	5,9	71,4	674,6
Media	31,4	20,7	41,0	30,9	38,8	39,6	32,6	54,0	57,2	37,4	42,8	42,4	471,4

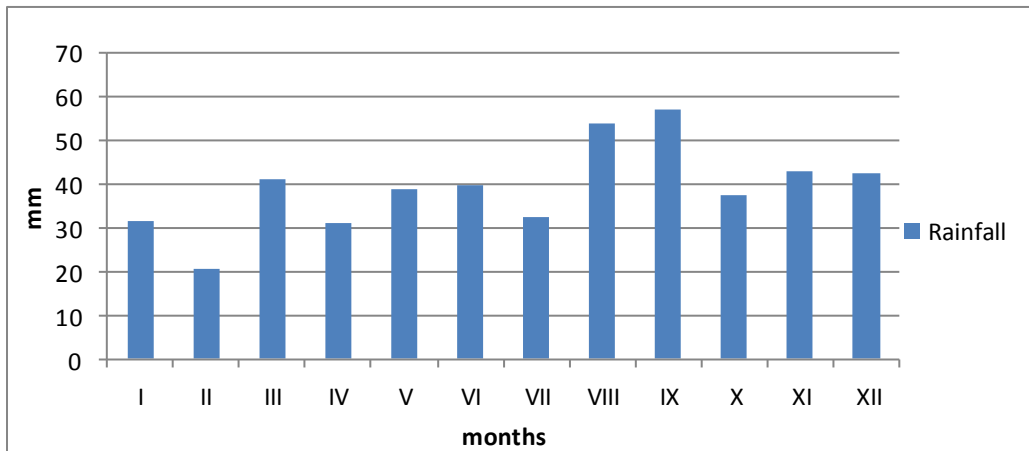


Figure 1: Monthly average rainfall during 1994-2004 in Constanta

For the period 1994 - 2004 recorded rainfall values ranged from 20.07 mm in february to 57.2 mm in september. The recorded annual average is of 471.4 mm which is within the average in the region of 400 - 500mm.

By following the evolution of seasonal precipitation you can see the following:

For winter, precipitation falls between 20.07 mm recorded in february and 42.4 mm in december. For the spring season precipitation falls between 30.39 mm in april and 41.0 mm in march. For summer precipitation falls between 32.6 mm in july and 54.0 mm in august. For autumn precipitation falls between 37.04 mm in october and 57.2 mm in september.

### 3. Floods in Năvodari and neighboring localities during 1994 – 2004

Study of heavy rains features based on data recorded on pluviograma. Multiannual statistical strings of these features allow calculating various parameters of interest fields above. The main parameters characterizing the torrential rains are:

- frequency of heavy rains - the warm semester (April to October);
- the duration of heavy rains;
- torrential rain intensity which is the amount of water in mm, fallen in one minute per  $m^2$ .

In Dobrogea is recorded the lowest annual average precipitation amounts in the country, 400-500 mm.

In areas close to the city Năvodari, in Lumina city, heavy rains caused outstanding floods. The major floods in the last 20 years occurred in 1994 and 2004. These floods occurred due to high amounts of precipitation. Thus, the flood produced in 1994, in July against the background of 53.8 mm average rainfall and flood of 2004 was due to precipitation of 259.2 mm recorded in august. At hydrometric Station Lumina, Valea Neagră River in the Central Dobrogea in an area of  $17 \text{ km}^2$  basin, during 9-11 VII 1994, there was a maximum flow  $Q_{\max} = 38.1 \text{ m}^3/\text{s}$  with a 5% insurance. Flood produced is the result of precipitation totaled  $39.0 \text{ mm}/m^2$  in the triggering flood gauging station at 12:30, the maximum being recorded at 13:30. Plain rain flood had a decrease for about 4 hours and 30 minutes before returning to normal drainage flow. Total time was about 5 hours and 30 minutes (Figure 2). Flood was due underdimensionnement a railway bridge upstream of the city, which led to the accumulation rate in the upper basin of water volume exceeded  $500,000 \text{ m}^3$  of water. Homes and household annexes, agricultural areas and the administrative center of the village were flooded.

All hydrometric station Lumina, Valea Neagră River, from 28 to 30 VIII 2004 maximum flow recorded was  $Q_{\max} = 35.8 \text{ m}^3/\text{s}$ . Flood produced is the result of precipitation totaled  $132.0 \text{ mm}/m^2$  in the triggering flood gauging station at 11:00 with a rise time of 10 hours, the maximum being recorded at 20:00. Rain flood plain had a decrease for about 11 hours until flows return to normal flow. The total time of the flood was almost 21 hours (Figure no. 3). Damage and flooding the administrative center of the village center houses made to propose a draft regulation and recalibration of course riverbed Black Valley executed and completed in 2009. Volume calculated by reconstructing flood water was about  $420,000 \text{ m}^3$  of water.

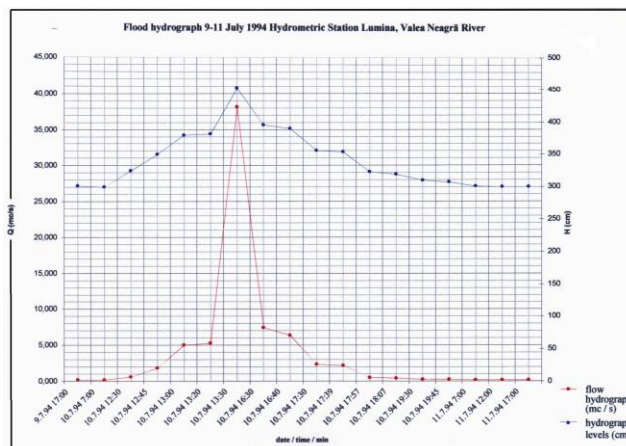


Figure no. 2 Flood of 9 - 11.07.1994 at hydrometric station Lumina, Valea Neagră River (data processing by the Environmental Protection Agency Constanta)

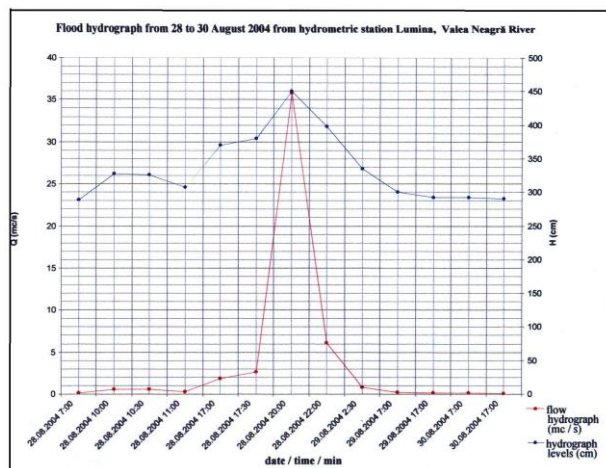


Figure 3: Flood of 28 - 08/30/2004 Hydrometric Station Lumina, Valea Neagră River (data processing by the Environmental Protection Agency Constanta)

## Conclusions

The following **conclusions** can be drawn:

- The average annual precipitation for the period 1994-2004 in Constanța records values 471.4 mm falling in the regions average
- Floods recorded in this period took place amid high amounts of rainfall. July 1994 achieved an average rainfall of 53.8 mm and flood of 2004 was due to precipitation of 259.2 mm in august.
- Damage caused during these floods relate to flooding houses, household annexes, agricultural areas, the administrative center of the village.

## References

1. Albu, Anca, 2009. *Climate-vegetation relationships in Southern Dobrogea*, Sentence of doctorate
2. Ciulache, S., 1992. *Meteorology and climatology*, Bucuretti University Publishing
3. Ciulache, S., Ionac, Nicoleta, 2003. *Glossary of Meteorology and Climatology*, Ars Decendi Publishing, Bucuresti
4. Ciulache, S., Torică, V., 2003. *Dobrogea Climate*, Analele University Bucuresti, tom. LII
5. Iancu, M., 1966. *Physical and geographical considerations on maritime Dobrogea. Maritime Dobrogea*, Society of Natural Sciences and Geography of RSR, Library Geographer, No. 4, Bucuresti
6. Neacta, O., Popovici, C., Popa, G., Tuinea, P., 1974. *Some climatic characteristics of the Romanian Black Sea Coast, Climatology studies I*, I.M.H., Bucuretti
7. Plesoianu, Daniela, 2011. *Current Situation of the Environment in the Midia-Navodari Area*, Journal Environmental Protection and Ecology, B.E.N.A, Book 1, p. 1 – 6.
8. \*\*\* (2005), *Romania's Climate* (coordinator: ST. Stoenescu, D. Keys), National Meteorology, Romanian Academy, Bucuresti
9. \*\*\* (1995), *Statistical Yearbook of Romania*, Bucuresti
10. \*\*\* (1996), *Statistical Yearbook of Romania*, Bucuresti
11. \*\*\* (1997), *Statistical Yearbook of Romania*, Bucuresti
12. \*\*\* (1998), *Statistical Yearbook of Romania*, Bucuresti
13. \*\*\* (1999), *Statistical Yearbook of Romania*, Bucuresti

14. \*\*\* (2000), *Statistical Yearbook of Romania*, Bucuresti
15. \*\*\* (2001), *Statistical Yearbook of Romania*, Bucuresti
16. \*\*\* (2002), *Statistical Yearbook of Romania*, Bucuresti
17. \*\*\* (2003), *Statistical Yearbook of Romania*, Bucuresti
18. \*\*\* (2004), *Statistical Yearbook of Romania*, Bucuresti
19. \*\*\* (2005), *Statistical Yearbook of Romania*, Bucuresti
20. \*\*\* (1995), *Report on the state of the environment in Constanta County in 1994*, Environmental Protection Agency Constanta
21. \*\*\* (2005), *Report on the state of the environment in Constanta County in 2004*, Environmental Protection Agency Constanta